

An  
Inaugural Dissertation.

on  
Tetanus.

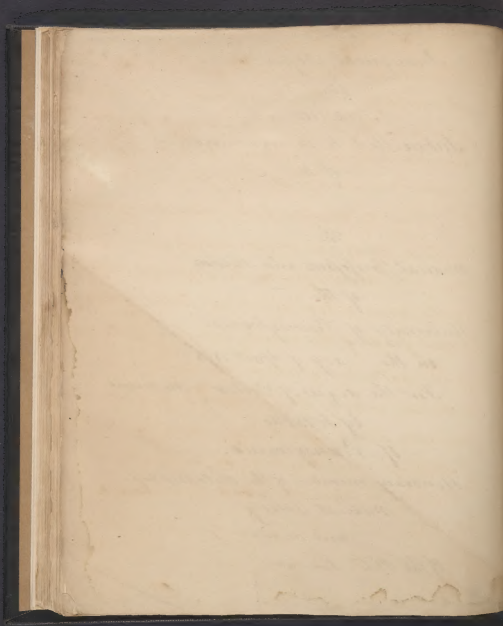
Submitted to the examination  
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on the day of April 1808

For the degree, of Doctor of Medicine  
by Jo<sup>h</sup>n B. Otto  
of Pennsylvania.

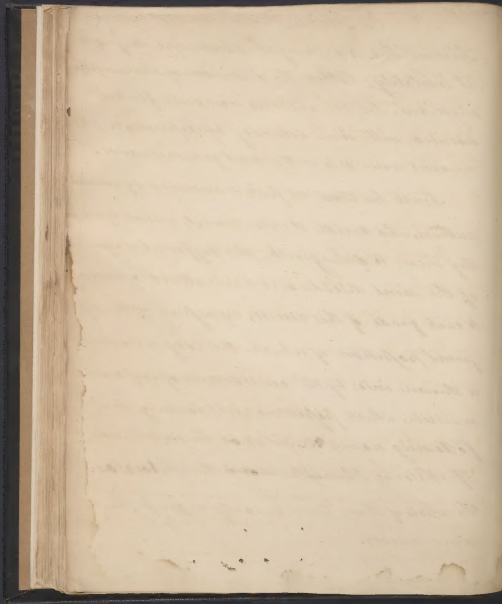
Honorary member of the Philadelphia  
Medical Society  
and member  
of the Phil<sup>a</sup> Linnaean



### On Tetanus.

Tetanus, this is a painful disease, and its frequent mortality; called the attention of the earliest physicians. In the ancient works, we find it described, with some accuracy by Hippocrates, who supposed wounds to be the most general cause.

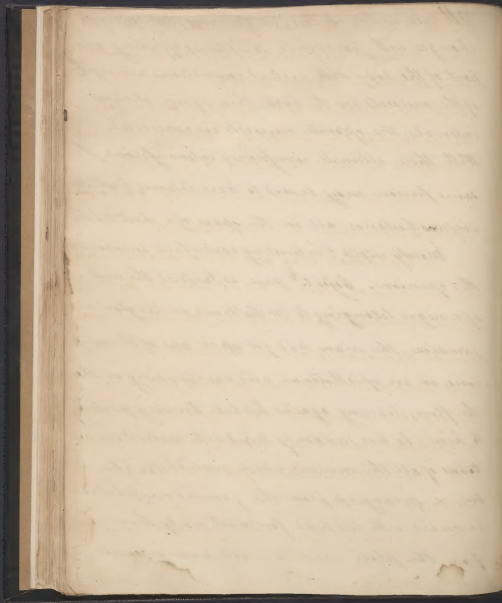
Since his time, we find it described by various authors, who divide it into several species, by which they mean to distinguish the different stages of the same disease; and have allotted a name to each grade of this disease, expressive of the different position of which the body is liable to be thrown into; by the contraction of certain muscles, which positions are known by the following names. viz. Tetanus, Emprostotonos, Opisthotonos, ~~Plumothant~~ Plumithobonos &c. The whole of these terms nearly express the same disease.



All late writers concur in opinion that tetanus changes with paroxysms, sometimes affecting one part of the body with violent contractions and rigidity of the muscles on the back, then again at short intervals, the opposite muscles are contracted.

With those alternate remissions & intermissions, the same person may be said to have tetanus, Opisthotonus, Crampas thostonos, all in the space of a short time.

Moseley relates 2 interesting cases which corroborate this opinion. Case 1. " Once, as I entered the hut of a negro belonging to Mr. St. Bond, in Kingston in Jamaica, the man had got up in one of the remissions, in an opisthotonus, and was standing on the floor, leaning against his bed. On my speaking to him, he was suddenly seized with violent contractions of all the muscles, which curved him like a bow, & sprang up from the ground and pitched backward, with his head foremost nearly three yards from the place where he stood, amongst some



poth that were in the corner of his hurt. By the fall  
he cut his head very much, & divided the temporal  
artery. He died within two hours.

Case 2. "In which every part of a woman's body  
was convulsed, or rendered stiff and rigid by turns.  
Sometimes her head was turned to the right side,  
then to the left, then backward as in the *opisthotonus*,  
then forward, as in the *emprostotonus*."

This disease may and does occasionally, occur  
in every climate that we are acquainted with.  
Yet it occurs most commonly, in the warmest regions  
of such climates. So much is indeed; that it has  
been considered endemical in such climates.

Hillery, observes the *orthotetanus*, suffered pretty much  
in a dry cool season; and several persons were seized  
with *opisthotonus* & *tetanus* from seemingly very  
slight causes.

Morely likewise remarks *tetanus*,





is endemical amongst children, many places between the tropics; but by no means, as some have supposed, depending on situations near the sea, or exposed to the winds; when it attack them, it is generally on the eight or ninth, and seldom after the twelfth or fourteenth day, from their birth.<sup>u</sup>

Though the causes do, upon occasion, affect all sorts of persons, they seem however, to attack persons of middle age more frequent than the older or younger, the male sex more frequent than the females, the robust & vigorous more frequent than the weaker.<sup>u</sup>

Monro remarks the negroes, are more subject to tetanus than the whites. Thus he supposes, is owing to an increase of irritability & diminished sensibility. He likewise observes the algerines & moroccans, are much distinguished for privation of sensibility.

The first of these is the fact that the  
 government has been unable to  
 maintain a stable currency. This  
 has been due to a variety of  
 causes, including the fact that  
 the government has been unable to  
 raise sufficient revenue to cover  
 its expenses. This has led to a  
 situation in which the government  
 has been forced to print money  
 to cover its deficits. This has  
 led to a rapid increase in the  
 money supply, which has in turn  
 led to a rapid increase in prices.  
 This is the classic case of  
 inflation, and it has been a  
 major problem for the government  
 for many years.

as the regimens. Here, I cannot agree with the illustrious  
morally, that this increase irascibility, & diminished sensibility  
is natural, but may be acquired from certain causes.  
Which I shall briefly enumerate. We have many instances  
of debility destroying pain; Hence criminals can  
bear the greatest punishments inflicted with fortitude;  
of this we have a striking instance, a case mentioned  
by Dr Priest, a man who was sentenced for some crime  
to suffer punishment at stated periods. He bore it  
with uncommon fortitude, and almost without a  
groan. Being asked how he bore it, he answered he  
always fastened 2 or 3 days before his punishment  
came on? Again, do we not see delicate females?  
who from disease have not taken much punishment,  
bear operations of the most painful kind with com-  
posure, and scarcely uttering a groan. Further,  
bleeding so much recommended in parturition to  
relax the rigidity of the os uteri and the adjacent parts,



pain its debilitating agency, also allivates pain. Lastly,  
do we not always lacerate before performing a pain-  
ful operation? this laceration is given with a view to  
relieve pain, which it does by producing indirect  
debility.

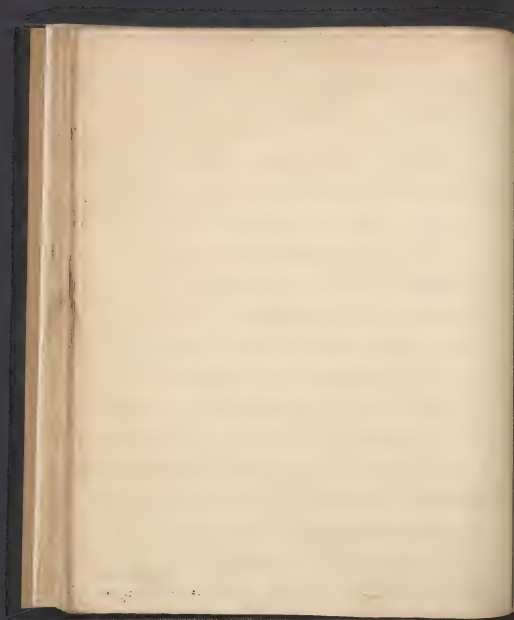
May not the sparing act, in addition to heat,  
labour fatigue &c. to which the negroes are generally  
confined to, bring on debility? which I have mentioned  
destroys sensibility in a great measure and consequen-  
tly the irritability will accumulate in equal ratio,  
to the diminution of sensibility. So this I attribute their  
fortitude under painful operations, and not to the  
natural irritability as usually supposed; but to their  
prematural irritability. These causes I conceive  
are sufficient explanation. why! the negroes are more  
subject to this disease than the whites. who from  
better circumstances, are not exposed to many  
of the above causes.



## Symptoms.

When this disease is brought on from cold, it generally makes its appearance; a few days after the applications of such colds. But when arising from punctures or lesions of the nerves, muscles, or tendons, it does not appear so soon. Frequently not until after the tenth day, but there are instances, in which 6 or 8 weeks have elapsed, after the last related exciting cause. Often do we see tetanus come on from wounds, when the patient is doing to all appearance well the wound healing kindly, the pain much diminished in the part, and the general health of the patient good. When suddenly an acute pain extending up the limbs when from wounds of the arms or legs to the neck, back, & frequently to the root of the tongue. Which pain is succeeded by spasm of the muscles of those parts constituting what is called tetanus.

The disease sometimes comes on suddenly to a violent degree, but more generally it ap- takes





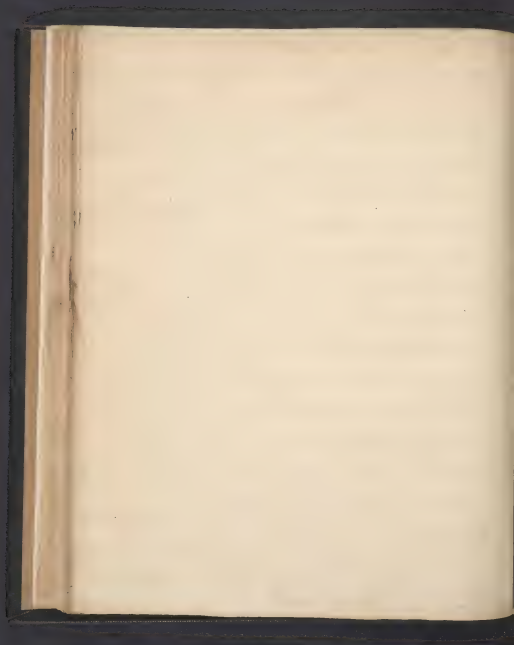
by slow degrees to its violent state. In this case it comes on with a sense of stiffness in the back part of the neck, which gradually increasing, renders the motions of the head difficult & painful. As the rigidity of the neck comes on increasing, there is commonly at the same time a sense of uneasiness felt about the root of the tongue, which by degrees, becomes difficult of swallowing, and at length an entire interruption of it. Whilst the rigidity of the neck goes on increasing, there arises a pain, often violent at the lower end of the sternum, and from thence shooting into the back. When this pain arises, all the muscles of the neck, & particularly those of the back part of it, are immediately affected with spasm pulling the head strongly backwards. At the same time, the muscles that pull up the lower jaw which upon the first approaches of the disease were affected with some spastic rigidity, are now generally affected with more violent spasm, and set the teeth so closely together



that they do not admit of the smallest opening.  
When the disease has advanced thus far, the pain  
at the bottom of the sternum returns very frequen-  
tly; and with it the spasms of the hind neck &  
lower jaw, are renewed with violence and much pain.  
As the disease thus proceeds, a greater number of mus-  
cles comes to be affected with spasms. After those  
of the neck, those along the whole of the spine become  
affected, bending the trunk of the body. During  
the whole of the disease, the abdominal muscles  
are violently affected with spasm so the belly is  
strongly retracted, and feels hard like a board.

At length the flexors of the head & trunk become  
so strongly affected as to balance the extensors, &  
to keep the head and trunk straight & rigidly extended  
incapable of being moved in any way; and it is to  
this state the term of tetanus has been strictly applied.

At the height of the disease, every organ of volun-  
tary motion seems to be affected; and amongst the  
muscles of the face.



The forehead is drawn up into furrows, the eyes, sometimes distorted, are commonly rigid, and immoveable in their sockets; the nose is drawn up, and the whole countenance expresses the most violent grinning. Under these universal spasms, a violent convulsion commonly comes on, and puts an end to life."

These spasms, are every where attended with most violent pains. The utmost violence of spasm is however, not constant; but, often subsisting for a minute or two, the muscles admit of some remission of their contraction, altho of no such relaxation as can allow the action of their antagonists.

This remission of ~~their~~ contraction gives also some remission of pain; but neither is of long duration. From time to time, the violent contractions & pains are renewed sometimes every ten or fifteen minutes, and that often without any evident exciting cause. But such exciting causes frequently occur, for almost every attempt of motion, as attempting



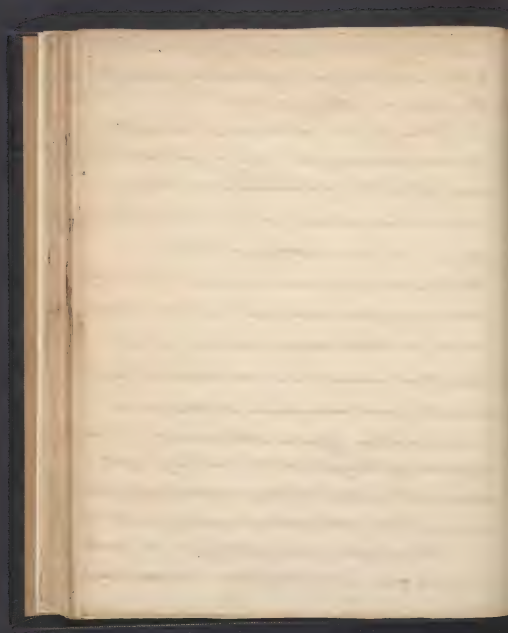
a change of posture, endeavoring to swallow & even to speak, sometimes gives occasions to a renewal of the spasms over the whole body."

"Although fever be not a constant attendant of this disease, especially when arising from lesions of nerves; yet in those cases <sup>proceeding</sup> ~~producing~~ from cold, a fever sometimes has supervened, and is said to have been attended with inflammatory symptoms."

"Blood has been often drawn in this disease, but never exhibits any inflammatory crust, and all accounts seem to agree that blood drawn seems to be of a looser texture than ordinary, and that it does not coagulate in the usual manner. — In this disease

the head is seldom affected with delirium, or even confusion of thought, till the last stage of it, when, by the repeated shocks of a violent distemper, every function of the system is greatly disordered.

Tetanus often proves fatal before the fourth day; and when a patient has passed this period, he may





be supposed to be in greater safety, & in general the disease is the safer the longer it has continued: It is however, to be particularly observed, that even for many days after the fourth, the disease continues to be dangerous, & even after some considerable abatement of its force, it is ready to recur again with its former violence and danger, It never admits of any sudden, or what is called critical solution, but always recedes by degrees only, and it is often very long before the whole of the symptoms disappear.

### Predisposing causes.

These are all such as induce debility either directly, or indirectly particularly of the muscles.

1. Cold this has long been considered, as an active agent in producing debility.

2. Debilitating passions of fear, grief, & despair.

3. Want of sufficient aliment. All these act, directly in inducing this debility.



4. Heat, this is universally acknowledge, to be the predisposing cause of tetanus. Hence the frequency of it in the tropical climates.

5. Unusual labour and exercise: hence we find tetanus more frequent occurring, from wounds received in battle, than at any other time.

To these causes may be added excess in venery, and indeed every thing which tends to induce debility.

From what has already been said, I infer that debility from abstraction or action, constitutes the predisposition of this disease. However, this debility does not appear to be universal, but more particularly seated in the muscles, which may be inferred from their being almost exclusively the seat of the disease, for were debility equal in every part of the body, we would have universal disease; as many of the occasional causes of tetanus, are such as frequently inducing fever when preceded this requisite predisposition.



Of the exciting causes.

The partial division of a nerve or tendon, was believed by the ancients to be the most frequent cause of this disease. By since those times experience & observation has taught us that superficial wounds, on any part of the body; may excite the disease,

Cold, this in some instances has been known to be the exciting cause of this disease, more especially after exposure to intense heat. Of this Sydenham mentioned many instances. Boerhaave relates an instance of its having been induced by a person's sleeping without a night cap after shaving his head. The cool air more certainly brings on this disease, if applied to the body in the form of a current.

Certain poisonous vegetables. There are several cases upon record of its being induced by hemlock, Dropwort and the delenia stramonium.

\* See the note vol 8 page 252. † Boston & Medical Sect.



Lastly, certain emotions and passions of the mind. "Senor brought it on a brewer in the city. He had been previously debilitated by great labour, in warm weather. I have heard of its having been induced in a man, by agitation of mind, occasioned by seeing a girl tread upon a nail. Fear excited it in a soldier who knelt down to be shot. Upon being pardoned he was unable to rise from a sudden attack of tetanus."

#### Of the pathology.

From the symptoms and many of the causes, am naturally led to suppose the disease to exist in the muscles, but in what manner the cause act appears difficult to ascertain. Mosely seems to suppose that it is a spasm ~~sited~~ <sup>sited</sup> only in the muscles & subservient to the animal functions. And this whether original, or symptomatical. "Is caused by irritation, which depending





alike upon irritating impressions, made upon any one part of the body, producing morbid excitement, or disease in another. It is immaterial whether the impression be made upon the intestines by worms, upon the ears by ungrateful noise, upon the mind by a strong emotion, or upon the sole of the foot by a nail; it is alike communicated to the muscles, which from their previous debility and irritability are thrown into commotion by it. In yielding to the impressions of irritants they follow their contractions the order of their predisposing ~~at~~ debility. The muscles which move the lower jaw, are affected more early, and more obstinately than any of the other external muscles of the body, only because they are more constantly in a relaxed or idle state."



*Trophylaxis.*

few diseases, which can with more certainty be prevented, in its forming state than tetanus. And to this period we should be particular attentive.

Thus from all its causes, has nearly the same premonitory symptoms. These are stiffness, in the neck, a disposition to bend forward, in order to relieve a pain in the back, costiveness, a pain about the region of the stomach, and a disposition short in sleep. In this full state of the disease, an emetic, a strong dose of laudanum, the warm bath, or a few doses of Bark, have often prevented it being completely formed. When it has arisen from a wound, dilating it, by applying to it turpentine common salt, corrosive sublimate, or spermacetie flies, have in many hundred instances attended with salutary effects. 49



## Cure.

The indications of cure are 1<sup>st</sup> to lessen or abstract the morbid excitement of the muscles, which may be accomplished 1<sup>st</sup> by Bloodletting, 2<sup>d</sup> Emetics, & 3<sup>d</sup> Purgatives. 2<sup>d</sup> after sufficient depletion to remove or overcome the disease by tonics & remedies. These are 1<sup>st</sup> opium, 2<sup>d</sup> Bark, 3<sup>d</sup> wine, 4<sup>th</sup> oil of Amber, 5<sup>th</sup> Cold & hot baths & mercury: each of which I shall briefly mention.

Bloodletting I find, has been mentioned as early as Hippocrates, & has been found very beneficial in tetanus, arising from cold; which according to Hillery's observation, are generally attended with phlogistic diathesis. It likewise has been found useful when arising from wounds attended with inflammatory symptoms.



## Emetics & Cathartics.

These have been employed in some cases with success, especially when the disease is the effect of fever, the same remedies should be given as are employed in the cure of that fever. I have once unlocked the jaws of a woman, who was seized to the same time with a remitting fever by emetic &c. They also prove serviceable, where acid substances or poisons are taken into the stomach. Purges may be used with a view to evacuate the elementary canal, thereby expelling the acrid feces & sometimes worms which cause irritation.

## Opium.

According to B. B. Haller, opium is universally necessary; and it must be given with <sup>a</sup>bold hand, and at short intervals of time between the doses, untill the end is answered. Mosely observes it has been given to the extent of one dram.





every two or three hours, together for several day without inducing sleep. But sleep in these large doses, as we often find it ineffectual in removing this disease.

### Bark and Wine.

Dr. Rush mentions one case, in which the opium failed in large & repeated doses, when it was immediately dismissed; and gave large quantities of bark & wine, to the amount of two or three ounces of the former, and from a bottle to three pints of the latter in a day; in a few ~~days~~ hours I was delighted with their effect: His spasms and pains were less frequent and violent; & he slept for several hours, which he had not done for several day & nights before. With the same indication in view, I applied a blister between his shoulders, and rubbed in two or three annes of mercurial ointment upon the outside of his throat. He continued to mend gradually under the operation of these medicines, so that on ten day he was out of danger. After the spasm continued in his arms & feet for several week afterwards. + [Memorandum of the Society, & Rush's case]



### *Ardent spirits.*

A quack in New England has lately cured tetanus, by giving it in such large quantities as to produce intoxication.

### *Oil of Amber.*

This from its action on the muscular system is much recommended, by many authors, in the cure of tetanus; and should be given in considerable doses and repeated.

### *Cold bath.*

This has in many instances performed cures, we find it mentioned by Hippocrates and since his time is recommended by many authors. In one of two cases in which I have used it with success the patient's jaw opened in a few minutes after the effusion of a single bucket upon her body.

### *Warm bath.*

This has often been used with success, mostly



cured a Captain Thompson of a tetanus, only by  
putting him into a warm bath, three times a  
day, and given him small doses of laudanum &  
antimonial wine. This medicine kept up a great  
perspiration, caused by the bath; which I judged  
to be the most proper method of treating a tetanus  
as his was from obstructed perspiration from the  
night air. x

### Mercury.

This has been employed with a view to salivate  
by many practitioners, and when this could be  
accomplish the disease generally terminated favo-  
rable. Dr Young mentions a case, which he cured  
by means of this medicine, after Opium, wine, bark,  
ol of Amber had failed. x. Stark also said he saw a case  
which was cured in the hospital by this medicine.  
But unfortunately the phlogism cannot be generally  
excited early enough to be of service.

x. Morley on tropical diseases pag 303. & Boston Med & Phys Journal  
vol 1 pag 67 by Young.

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## Sealons.

Have ~~been~~ often been used with advantage.  
Desportes says, he cured a negro woman by  
making a sealon in her neck, with an hot needle  
Blisters.

Dr Girdlestone commend, Blisters in high tems  
in this disease. He says he never saw it prove  
fatal, even where they only produced a scum  
on the skin. x

